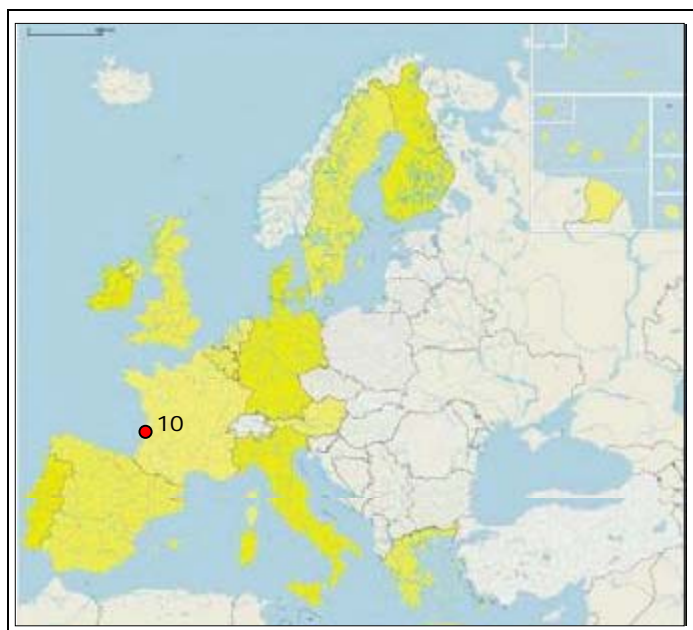


AQUITAINE COAST (FRANCE)



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1. GENERAL DESCRIPTION OF THE AREA

The Aquitaine coast is located in the southwest of France, and forms a vast triangular basin surrounded to the north-east by the hercynian terrains of the Massif Armoricaïn and the Massif Central, which join with the Pyrenees to the south through the Montagne Noire.

1.1 Physical process level

1.1.1 Classification

- General: sandy beaches
- CORINE: beaches
- Coastal guide: coastal plain

The Aquitaine coast is a straight sedimentary coast with a longitudinal dune system, with several lagoons (the largest of which is the Arcachon lagoon). The study area comprises two coastal towns: Lacanau and Cap-Ferret (see Figure1).

1.1.2 Geology

Aquitaine is a coastal plain composed of quaternary sediment. The main coastal formations are sand dunes, with the highest dune formation known in Europe. The characteristic sediment of this coast is well sorted sand, of medium to fine grain size (~300µm. The continental shelf forms a wide plateau of the "depositional type".

1.1.3 Morphology of the coast

Along the Atlantic ocean, the 230km-long sandy coast of Aquitaine region (see Figure 1) is limited to the south by the Ardour river and to the north by the mouth of the Gironde estuary issued from the junction between the Garonne and Dordogne rivers which drain respectively the Massif central mountains, and the Pyrenees. The only interruption in this linear coast, which is oriented south to north, is formed by the presence of the Arcachon lagoon.

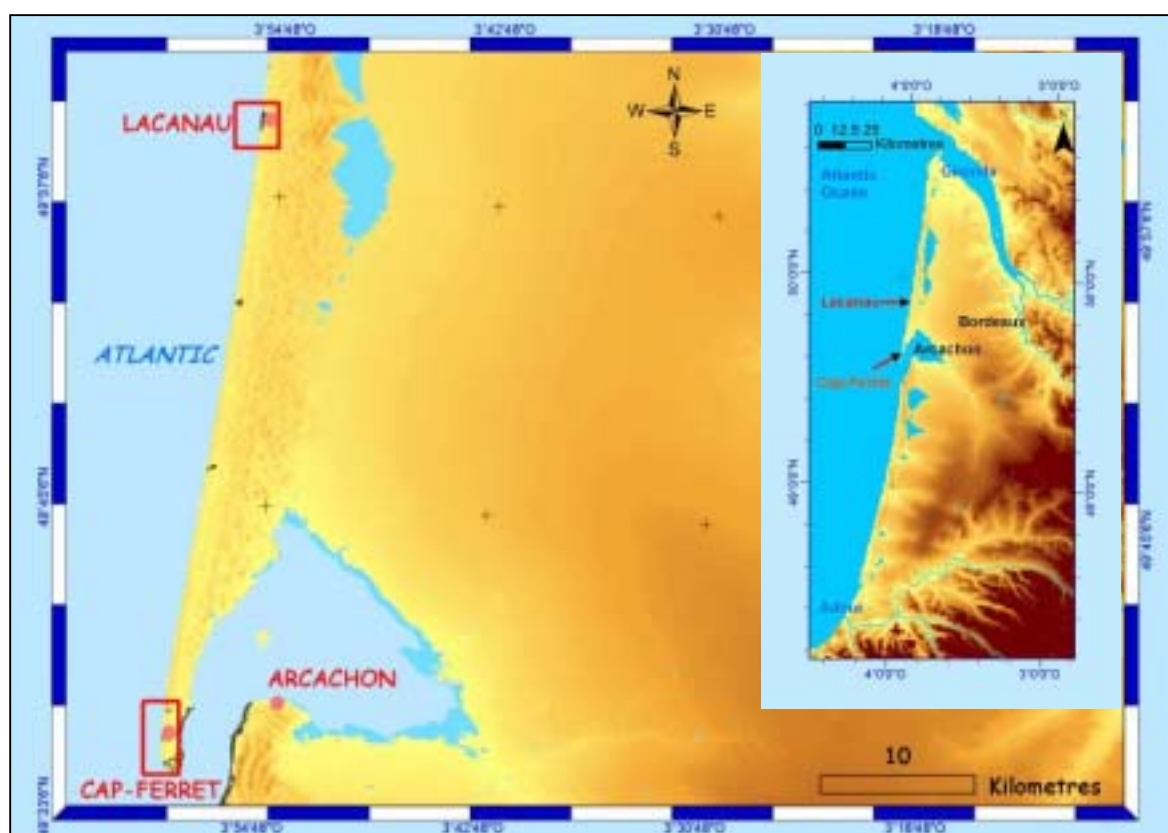


Fig. 1: Map of the Aquitaine coast (SW France) and location of the two studied sites.

1.1.4 Physical processes

The Aquitaine basin is influenced by the temperate oceanic climate characteristic of middle latitude coasts adjacent to the Atlantic Ocean. The regime is characterised by frequent and prolonged rainfall of relatively low intensity. The maximum rainfall occurs in autumn during which the polar front descends to the middle latitudes; the minimum rainfall occurs in summer.

The tidal range varies from 2m to 5.5m between neap and spring periods. The tidal waves propagates from the south to the north along the coast. The mean annual significant wave height in Biscarrosse (SW of Arcachon lagoon) is 1.4m and the mean annual period is 6.5s, associated with long distance swell traveling mainly from N-NW directions (Butel et al., subbmitted).

1.1.5 Erosion

From 1966 to 1998, the evolution of the coastline has been calculated which is resumed in Figure 2, showing sedimentary accretion, erosion and stable areas.

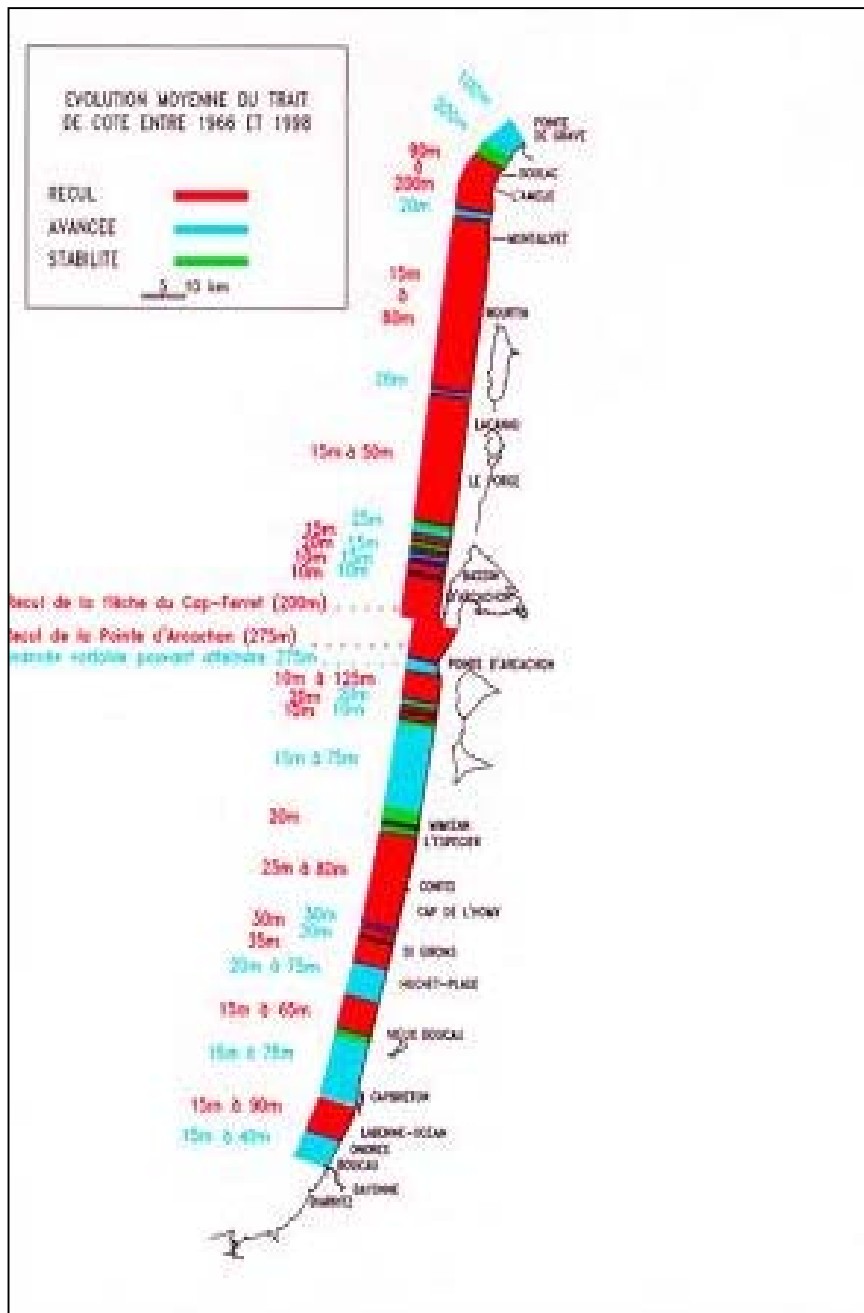


Fig. 2: Coastline evolution from 1966 to 1998 for the Aquitaine coast.

Erosion is due to the globally observed trend of detritated sediment lack along the coast (decreasing sediment input) and to the action of dynamic agents - wave activity, aeolian transport, tidal currents...- (see Figure 3). Under the dominant waves, the longshore drift is mainly southward oriented and has been estimated roughly around $500,000\text{m}^3/\text{m}/\text{yr}$. South of the Gironde estuary, the longshore drift is oriented toward the northeast. The mean eolian sand transport is estimated (Pedreros, 2001) between 6 and $7.4\text{m}^3/\text{m}/\text{yr}$. These volumes are mainly transported from the beach and deposited at the boundary between the beach and the dune. The wind action causes the eastward displacement of the dunes and increases sand transport where the dune is not covered by vegetation.

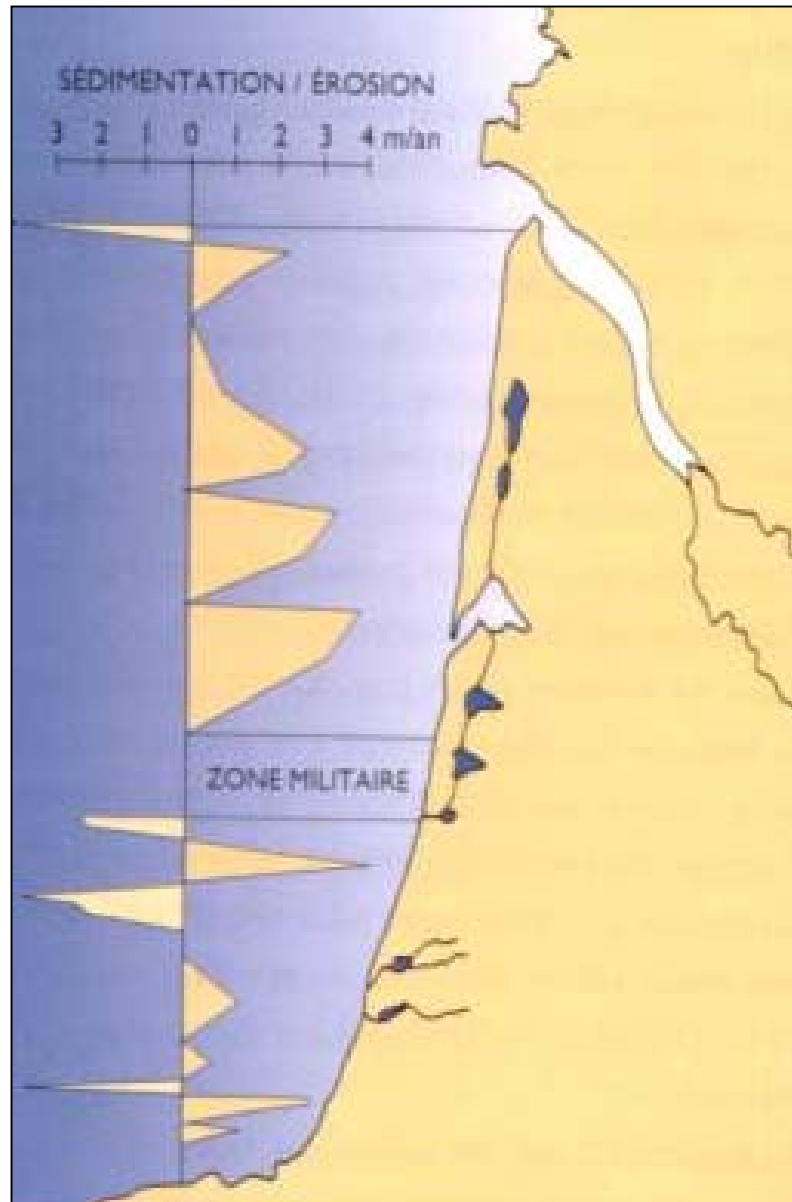


Fig. 3: Erosion rates of the Aquitaine coast.

1.2 Socio-economic aspects

1.2.1 Population rate

The total population of Lacanau and CapFerret comprise 9200 inhabitants.



1.2.2 Major functions of the coastal zone

- Agriculture and forestry
- Fisheries and aquaculture (oysters)
- Tourism and recreation

1.2.3 Land use

Small urban zone and beaches around with amenities for access and sanitary installations, shops, parking, restaurants.

Protected areas:

- Out of town = "Coastal Law" (no construction 100m from the seafront, protection forest - no forestry exploitation but protected dunes...)

1.2.4 Assessment of capital at risk

Unknown.



2. PROBLEM DESCRIPTION

2.1 Eroding sites

In Lacanau the shoreline movement can reach -66m. The protection against erosion consists of two perpendicular groins (130m long) and a longitudinal dyke (~1.1km long). The town is located just on top of the dunes. See evolution of the Lacanau town shoreline in Figure 4.

In Cap-Ferret, the geographic situation is different: the town is located on a sand spit generated by the littoral drift, which separates the Arcachon lagoon from the ocean. The oceanic coast is more "natural" with no specific protection against marine erosion. In general habitation is sparse and located in the limit between dune and forest. The town centre is located at the centre of the sand spit, one kilometre away from the ocean. See evolution of the Cap Ferret shoreline in Figure 5.

All along the coast (both Cap-Ferret and Lacanau) the dunes are generally maintained by the *Office National des Forêts* by implanting of specific vegetation to stop the sand transport due to aeolian erosion.

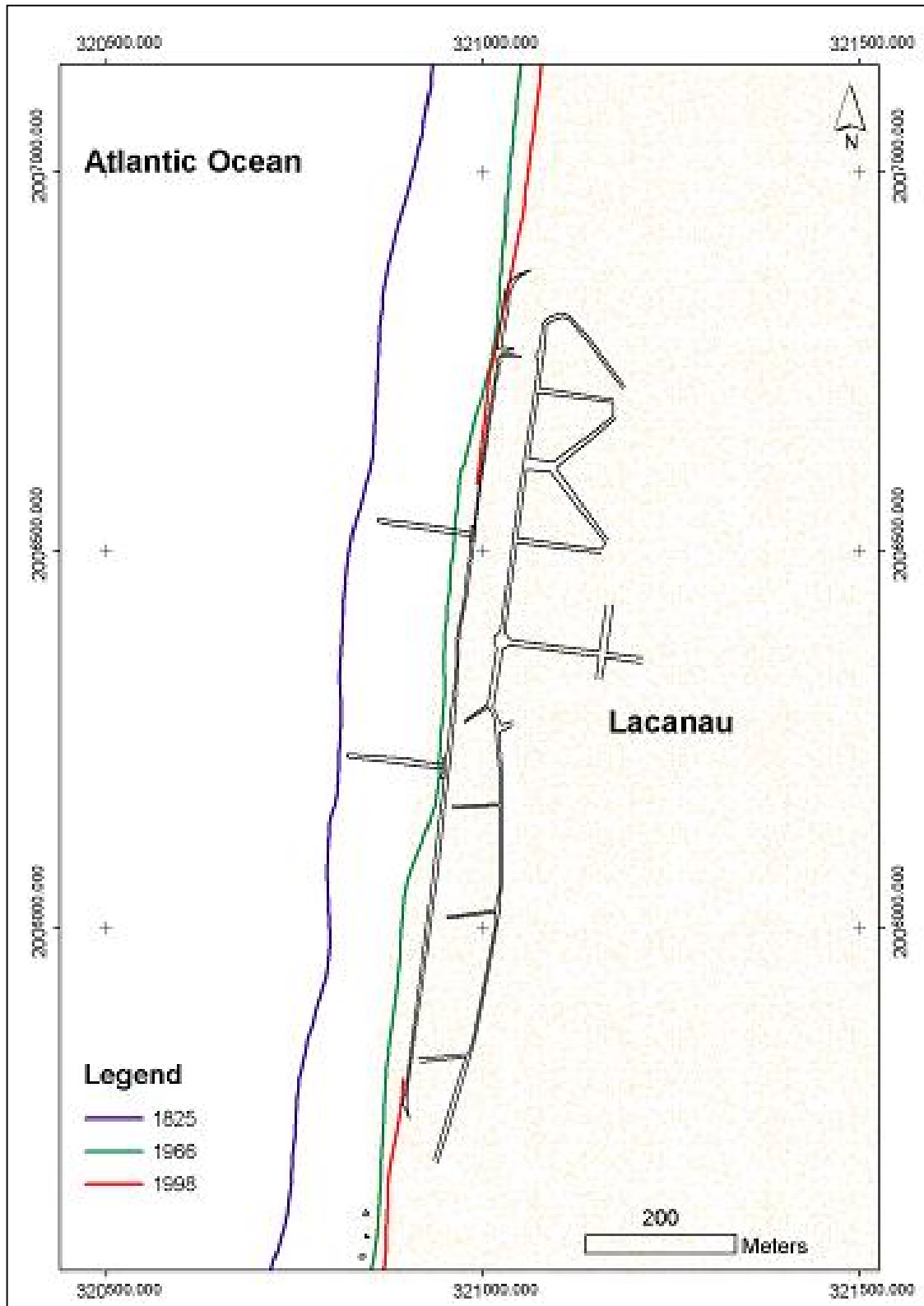


Fig. 4: Coastline evolution in Lacanau.

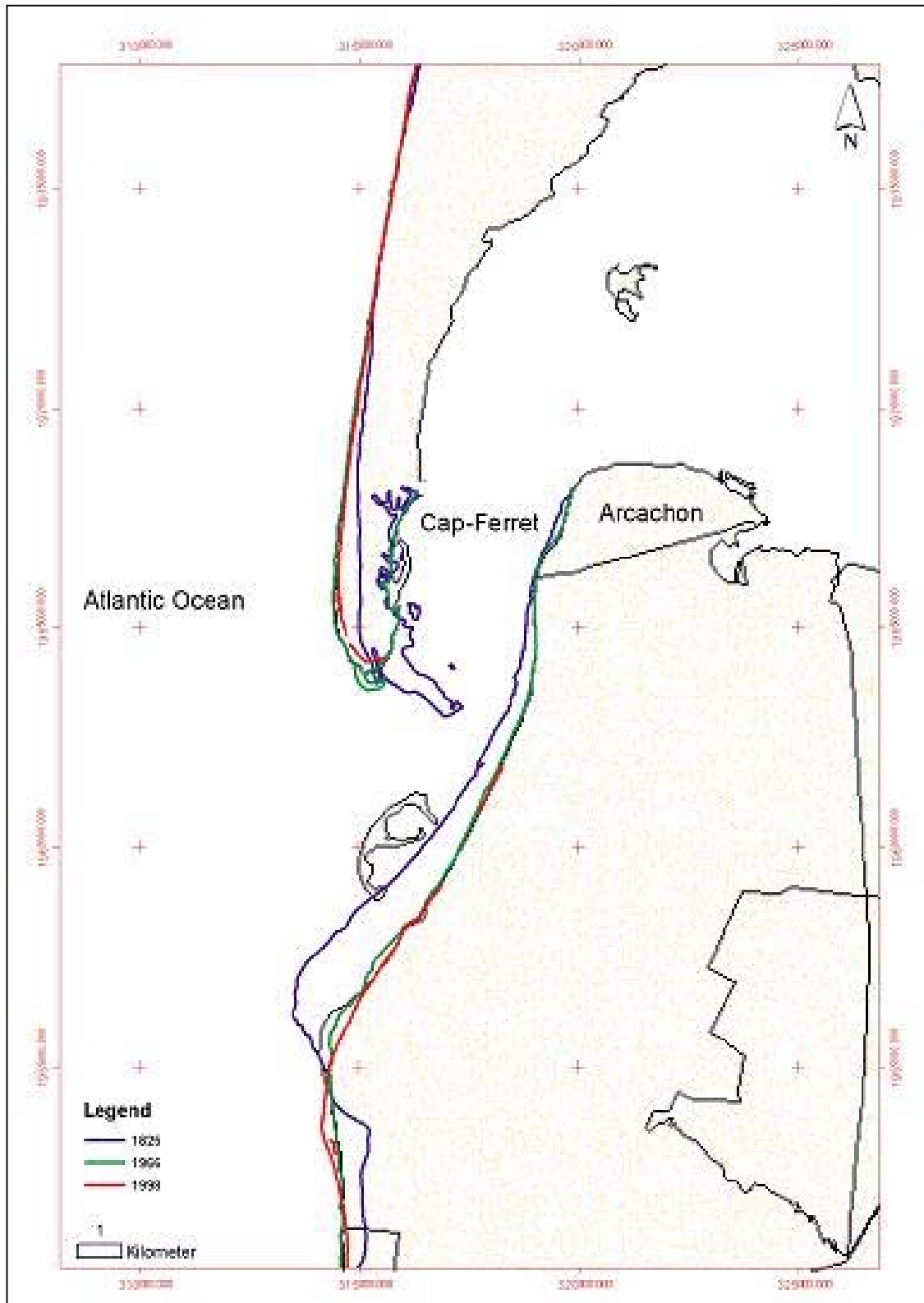


Fig. 5: Coastline evolution in the mouth of the Arcachon Lagoon (Cap Ferret).

2.2 Impacts

Erosion along the Aquitaine coast causes a high risk of flooding. First, the wind action causes the eastward displacement of the dunes and increases the sand transport in places where the dune is not covered by vegetation as for example the non-protected pedestrian paths. Secondly, the sand dune migrates toward the ocean by marine erosion.

Ideally, when there is no habitation or protection, the “beach-dune” system migrates onshore or offshore between ocean and forest. In summer or during accretion periods, the system stocks a volume of sand, and in winter or during erosion period, the system loses sediment (e.g. to the benefit of subtidal bars). When habitation or strong protection exist, erosion is accentuated downstream the littoral drift. A longitudinal seawall will increase the wave action since waves are reflected which induces a backwash current which transports the sand seaward. Lacanau is subject to these types of erosion, which is representative of the coastal towns in Aquitaine.



Fig. 6: South view of the Lacanau town. Visible are a few groins constructed to retain sediment of the longshore drift in front of the town.

3. SOLUTIONS/MEASURES

3.1 Policy options

Hold the line.

3.2 Strategy

3.2.1 Approach related to the problem

The strategy is to use 'soft' methods such as covering the dunes with vegetation, beach nourishments or though mechanical by-pass in front of the groins. 'Hard' methods consist in keeping the existing engineering structures in a good shape.

3.2.2 Issues concerning threat to life and property

Unknown.

3.3 Technical measures

Nowadays the most effective protection is covering the dunes with vegetation, which consists of placing barriers of cut branches, which are gathered in the forest, or the installation of artificial wind breakers to stop the advance of the sand. The maintenance work is completed by the installation of indigenous vegetation which forms a herbaceous carpet to hold the dune in place (see Figure 7). Reshaping of dunes by a bulldozer is used only in case of emergency.

Other measures are placing hard structures such as seawalls, groins and revetments (see Figures 8, 9 & 10).



Fig. 7: Revegetation of dunes.



Fig. 8: Hard structures – seawall.



Fig. 9: Hard structures – groins.



Fig. 10: Hard structures – rock revetments.



4. EFFECTS AND LESSONS LEARNT

4.1 Effects related to erosion

Civil engineering structures tend to increase erosion. These effects can be nullified with beach nourishment operations.

4.2 Effects related to socio-economic aspects

Unknown.

4.3 Effects in neighbouring regions

Unknown.

4.4 Relation with ICZM

In France all the beaches belong to the public domain. Most of the ICZM practises come from the "Coastal Law Rule": Forest code art L 131-1 (Protection against the erosion by plantation of forests behind dunes).



5. REFERENCES

Butel, R.; Dupuis, H.; Bonneton, P. (2002). *Spatial variability of wave conditions on the French Atlantic coast using in-situ data.* Submitted.

Pedreras, R. (2000). *Quantification et modélisation du transport éolien au niveau des zones côtières, application au littoral girondin:* Thesis from Université Bordeaux 1, n° 2312, 195 p.